



The Serge Modular Creature

An Unauthorized User's Manual

The Serge Modular *Creature*: An Unauthorized User's Manual

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Version 1.0: September 2010

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Foreword

Why This Manual?

While modular synthesizers are generally regarded as icons of electronic music from the 1970's, the fact is that they have never been as plentiful and affordable as they are right now, decades later. But learning how to use them is certainly no easier—and perhaps even more difficult—than it has ever been, even with the advent of the Worldwide Web. Mainstream information sources seem almost wholly oblivious to the fact that these machines are more popular than ever, and currently focus their efforts almost exclusively on computers and mass-market software 'plug-ins.' And the documentation that is shipped along with the majority of these machines is extremely cursory when it is provided *at all*, which in my experience is almost never.

Because of this, learning how to use a modular synthesizer is more difficult than it needs to be. In the case of so-called “West Coast” instruments such as the Serge Modular system, this is doubly so (the Serge can be opaque even to someone like myself, who has been using modular synthesizers for thirty-five years).

The reason for this lack of documentation is not entirely clear. Most of these systems are designed and built by small shops that perhaps do not have the resources or expertise to create good documentation, or perhaps feel it is cost-prohibitive. Further, the “boutique” nature of this field may foster an erroneous attitude that anyone with the money and desire to own such instruments surely has a solid understanding of these complex machines already.

It has also been suggested that a lack of formal guidance is a *good* thing, that it forces the student of the instrument to experiment and learn through “doing” while exploring all of the rich features of these instruments. This is perhaps the most likely explanation for the scarcity of documentation in the case of the Serge, but I suggest that this reasoning is unhelpful for several reasons.

First, adept use of a modular synthesizer is a technically demanding endeavor to say the least (especially in the case of “West Coast” machines, in my humble “East Coast” opinion). In what other field—even with regard to learning any other musical instrument—is the preferred method of gathering expertise to leave the student to flounder without guidance? This is like throwing someone into the deep end of a pool to teach them how to swim... sure, it's been tried, but it's more discouraging (and dangerous) than it is helpful.

Second, a person can grope in the dark trying to find something for a long time, never realizing that the elusive target of their search was often just inches out of reach the whole time. Why put a budding synthesist through that when a few helpful words or diagrams could open up new vistas of sound creation for that person?

Third, no matter how much someone knows about the use of modular electronic music synthesizers, there will *always* be experimentation and discovery *anyway*. This is the great joy of our instrument above all others, the seemingly endless possibilities that we cannot help but uncover with every hour that we spend with these wonderful and inspiring tools. To presume that the only way to foster the excitement of experimentation in a novice user is to blindfold them is in my opinion fallacious reasoning. The more one knows about their synthesizer, the higher the quality of experimentation.

The Serge synthesizer, available through *Sound Transform Systems* (“STS”), has been with the electronic music community for decades. Originally created by Serge Tcherepnin as a low-cost alternative to instruments like those made by Don Buchla, the Serge is now ironically among the most expensive of analog synthesizers available, enjoying a prestigious ‘boutique’ place in the market. The peculiar “physically non-modular” design of this modular system has created a price barrier that has discouraged many from being able to experience this instrument. (I myself have only now paid the entrance fee after thirty years of being curious about the Serge.) Modules had to be purchased in complete, custom-built panels, and so even a first purchase bore a considerable price tag; later upgrades were subject to the same obstacle. In recent years, STS has moved to a “shop panels” business model, moving away from custom panels toward a selection of pre-specified module arrangements. But while that decision may have ameliorated production costs somewhat, it did nothing to lower the final prices of the panels, so the problem was the same—a system could only be started or expanded in increments of full [17”] panels, which cost \$3500 and up.

STS has now introduced a smaller format panel, the “M-Class” panels, called “M-Modules.” While still not fully modular in the traditional sense, these new panel arrangements are the smallest ‘increment’ purchases since the earliest days of the Serge system. They are essentially half-panels (slightly less than half of a traditional Serge panel, actually) that still bear the distinctive Serge appearance and functionality. For the synthesist on a budget who has been curious to experience the Serge synthesizing paradigm, these M-Class panels are the best news in decades.

One M-Module in particular seems aimed squarely at the first-time Serge buyer: the “Creature.” This panel is unique in the lineup in that it is somewhat “self-contained”—it provides enough functionality to create and shape sounds in the smallest Serge form factor to date.

But the *Creature* is hardly a traditional synthesizer voice in the sense that, for instance, an Oberheim SEM was. At first glance, the only recognizable function on this panel even to an experienced synthesist is the voltage-controlled filter. There is no apparent sign of a VCO, VCA, LFO, or EG. In fact, these functions *are* available on the *Creature*, but only after understanding not only the Serge synthesizer paradigm but the peculiar functions of these circuits can one “find” them.

Sitting down to play with a *Creature* without some idea of where to start can be an exercise in frustration. Many times one begins to get a feeling for how a particular function block behaves only to have it suddenly stop working, never realizing that the inactivity is because of some slightly out-of-range voltage, a gate that terminated in the wrong “state,” or a knob being a paltry two degrees too far turned to the left or right.

Even after coming to some understanding of the Serge approach, I still found wrangling a *Creature* more confusing than any other synthesizer I have ever owned, by orders of magnitude. I was all but thrown into that proverbial ‘deep end of the pool,’ but I decided to methodically document my experiences as I made headway, and to organize these in such a way as to help others who may be testing the Serge waters to see if they might like to experience this system first-hand.

While I am an experienced synthesist, I consider myself a very ‘green’ Serge user. Therefore, please treat this document as ‘thinking aloud’ as I develop my own understanding of this instrument. I sincerely feel that making public that which I have discovered in working with my Serge will in no way detract from anyone’s enjoyment of the Serge Modular, and may in fact help at least a few others to understand the Serge system, and possibly even encourage some to purchase a *Creature* and try the experience for themselves. Even for someone familiar with modular sound synthesis, the Serge experience is quite unique and if possible, not to be missed.

If you feel you have a patch which demonstrates a function of the *Creature* that I have overlooked (probably because I haven’t found it yet—I know they exist!), please use the patch sheet in this manual and send me what you have, with an explanation, to be included in the next release of this guide.

Scope

Because of its functions and price point, the Serge *Creature* panel is a *de facto* “introductory” purchase for many curious about the Serge synthesis system. With the exception of a preparatory chapter on the overall system, I have tried to limit the scope of this manual only to that panel, just as if this guide were shipped with that purchase. As with any modular synthesizer, the functionality of any particular module is magnified geometrically by the addition of more and more modules, and the *Creature* is no exception. But the primary reason for this document remains: to treat the Serge *Creature* as an introduction to the Serge system. And so for the most part, this manual will be limited to the functionality available only on that panel.

The one exception to this I make is in the supposition later on that the user has some kind of keyboard or other controller that s/he can use with the *Creature*. This is not much of an assumption, I think, as low-cost MIDI keyboards are plentiful, and devices for converting MIDI to control voltages are readily available. Anyone with the drive (and purchasing power) to try a Serge system most likely has a controller of some sort available.

Of course, the preferred controller for the Serge system is the Touch-Activated Keyboard Sequencer (“TKB”), a brilliant combination of a rank of customizable “keys” and a 16x4 analog sequencer. So where I do make reference to an external controller, I will use the TKB (without diving too deeply into its functions), as much as a default as to perhaps suggest to a budding Serge synthesist where the road leads.

While I have endeavored to be as clear as I can in this document, it does assume some basic familiarity with the use of electronic music synthesizers, particularly analog modular instruments. Perhaps the audience for whom it is most intended is synthesists familiar with more “conventional” machines that would like to better understand the Serge Modular, and like me, are frustrated with the lack of reading material available.

The Serge has long been clouded in mystery; some of that is unavoidable owing to its radical departure from mainstream analog synthesizer structure and terminology. But that is what makes the Serge interesting, so hopefully clearing away some of the fog will aid in more people finding enjoyment in this unique system.

Acknowledgements

Naturally this manual would never have been realized without Serge Tcherepnin's creation of the Serge synthesizer system, and Rex Probe and the talented people of *Sound Transform Systems* for not only keeping that system available and extending it, but for creating the M-Class M-Modules that inspired this specific research.

Further, while *STS* has no current worldwide web presence, James D. Maeir's enthusiastic and helpful web pages devoted to the Serge synthesizer (www.carbon111.com/serge_index.html) continue to be an inspiration and help to me, as is the site 'serge-fans' (www.serge-fans.com) For anyone seeking more information on the Serge, these two sites are must-visit locations.

The only other print documentation I could find explaining in any way the functioning of the Serge synthesizer are in the form of an old print catalog from 1982 (perhaps the last time such official documentation was updated?) and the Serge Guidebook written by Rich Gold. Before having hands-on access to the modules, I found these documents unenlightening, but after having experienced the *Creature*, referring back to them does help answer a few questions.

For information about purchasing Serge synthesizer components, contact *Sound Transform Systems* directly at (262) 367-3030.

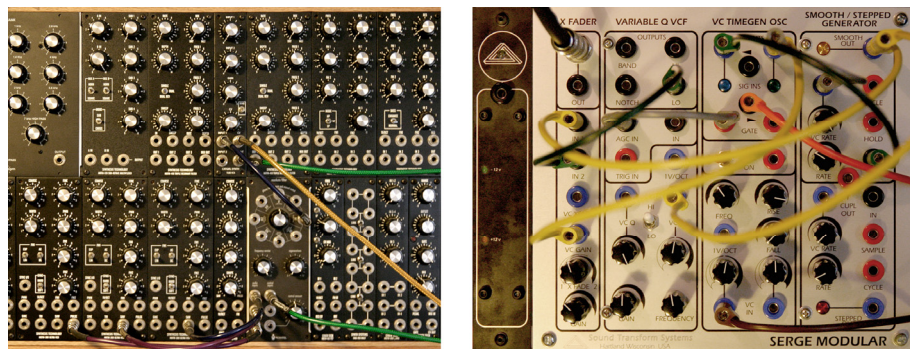
The Serge Synthesizer System

East Coast vs. West Coast Synthesizers

Modern electronic music synthesizers can generally trace their lineage back to two “fathers”—Robert Moog and Donald Buchla, the two men who firmly established voltage-control as a standard for patch-programming electronic components into sound-shaping instruments. Moog’s name has become a household word, even outside of the electronic music community. Back in the 1970’s, people freely referred to all synthesizers as “Moogs” (whether they pronounced his name properly or not). Moog Music produced the iconic modular synthesizer used by Wendy Carlos, Isao Tomita, Keith Emerson, and others, and this machine set the patterns for many synthesizer designers to follow. Through the Moog Modular (and its infamous little brother the Minimoog), terms like “voltage-controlled oscillator,” “voltage-controlled low pass filter,” and “envelope generator” crept into the vocabulary of those wishing to create and shape sounds with synthesizers. Moog’s designs continue to inspire a new generation of modular synthesizer designers.

Much less familiar, but working at the same time as Moog on the opposite shore of the United States, was Donald Buchla. His machines followed a different, perhaps less “mass-market” evolutionary path than Moog’s. Buchla’s devices were also voltage-controlled, but as he was less interested in developing instruments that would produce ‘conventional’ music, his synthesizers bore only a passing resemblance to the Moog standards with which musicians were becoming familiar. This is evident even at first glance—not only is the terminology different, but the method of connecting modules and even the ‘keyboard’ controllers followed a different development path.

At some point, the Moog-like synthesizers were dubbed “East Coast” machines, and the Buchla-inspired synthesizers, “West Coast.” The terms seemed to fit, and they stuck. They are a handy way of quickly differentiating these two great design paradigms seen to varying degrees in the vast majority of synthesizers, even those that are no longer analog or modular.



Examples of “East Coast” and “West Coast” analog modular synthesizers.

The Serge Modular easily falls more into the “West Coast” camp than the alternative. It uses banana cables rather than phone plug-style patchcords. Its primary controller, the Touch Activated Keyboard Sequencer, is an extremely powerful and flexible device, arguably less suited to conventional music than a standard clavier, but offering amazing functionality for “true” electronic music. Serge modules are not the macro-level, “molecular” aggregations of function that one sees on the Moog, but rather much more “atomic,” low-level function blocks. Just as it can be said that one “builds” an instrument using synthesizer modules, with the Serge, one builds synthesizer modules from these more elemental but ultimately more generalized and flexible circuits.

Modules vs. Function Blocks

The Serge Modular boasts a “high functional density.” What this means is that, for every square inch of front panel space, there is much more utility available compared to other synthesizers. This is achieved in part by tightly grouping controls, in part through the use of stackable ‘banana plugs,’ but primarily because each control grouping can be pressed into a wide variety of behaviors depending upon how it is configured.

On his website, James Maier makes a semantic distinction between conventional analog synthesizer modules and the more ‘atomic’ kind found on the Serge. He refers to the latter as “function blocks,” and that is perhaps a more helpful way to regard them, so I will use that terminology here.

A quick comparison of several synthesizer modules and a Serge function block helps make this clear. Below is listed a variety of common, easily-understood “East Coast” synthesizer modules and their functions:

- **Envelope Generator:** When signaled into action, creates a rising & falling voltage, with controllable rates. Used to control various aspects of sounds, primarily the gain of a voltage-controlled amplifier, the cutoff frequency of a filter, etc.
- **Glide/Portamento/Slew/Lag:** Slows the rise and fall of a control voltage, sometimes each independently, to varying degrees. Used primarily to slow or slur the transitions between the pitches of consecutive sound events.
- **Low Frequency Oscillator:** Creates a voltage that cycles up and down, often with a variety of waveshapes. Useful for vibrato and tremolo effects.
- **Voltage-Controlled Oscillator:** An analog synthesizer's primary source of harmonic sound. Creates one or more waveforms whose pitch can be controlled from an outside voltage, such as a keyboard.
- **Frequency Divider:** Takes in a signal at a particular frequency and outputs a new signal at a lower frequency. Useful in the audio range for creating new pitches in relation to the source oscillator, and for creating rhythmically related pulses in the control range.
- **Voltage-Controlled Low-Pass Filter:** processes an incoming audio signal by “rolling off” high frequencies to varying degrees.
- **Trigger/Gate Delay:** Receives a logic pulse and passes it to its output, but after a user-selectable delay. Useful for precisely controlling a series of events.
- **Envelope Follower:** Outputs a voltage that mimics the overall amplitude of an input signal, often used for processing acoustic sources with filters that track the loudness of the source signal.

Each of the above modules has a primary function and is customized to that task. However in the Serge system, there are many ways to achieve each of these goals, and a single nine-square-inch function block called the

“Universal Slope Generator” can do *all* of them to some extent, depending upon how it is connected. Further, the Slope Generator has other available functions not explicitly mentioned in this list.

Now, this is in many ways an apples-to-oranges comparison. The former modules are carefully tuned to their primary function and are easily understood, wide-ranging, more quickly accessible, often more ‘linear,’ and it may be possible to use them in very specific ways that would be difficult if not impossible for the Slope Generator to exactly emulate. But the fact remains that the more generalized, low-level Serge function blocks have incredible flexibility by comparison. And what the Slope Generator cannot do, a different circuit or group of connected function blocks probably can.

How is it that one small module can offer so much functionality? Much of that has to do with the specifics of the electronic circuits in all of these modules. A Glide/Lag module is at heart a simple circuit known as an “integrator,” a circuit which resists rapid changes in voltage. An Envelope Generator is little more than a couple of integrators, reacting either to the trigger (Attack-Decay), gate logic (Attack-Sustain-Release), or both (Attack-Decay-Sustain-Release). Integrators may be found in the hearts of oscillators, both VCOs and LFOs, as well as in their waveshaping circuitry. A Lowpass filter is a form of integration. An Envelope Follower smoothes or “integrates” the amplitude of an audio signal, and so on.

The “East Coast” modules are designed from the ‘outside-in’ with their eventual application in mind; the Serge modules seem designed from the inside-out. In fact, many of the more mysterious Serge function blocks are integrators in one form or another (but the Dual Universal Slope Generator {“DSG”} is arguably the most versatile single unit in the Serge lineup; STS now offers a “Quad Slope” M-Module with four of these function blocks, and it is something of a synthesizer in itself!).

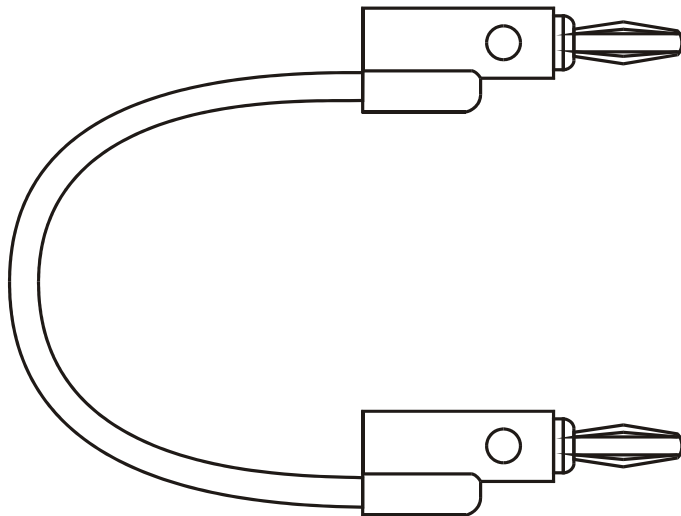
“Patching” the Serge

With any modular synthesizer, its main strength lies in its flexibility. Functional elements are not ‘hard-wired,’ but leave the organizing of their connections to the end-user, the synthesist. These modular functions are interconnected (with a few notable exceptions) through the use of patchcords—cables with handy connectors on each end—and the act of wiring-up a collection of modules into a synthesizer voice is called “patching”; the final configuration is commonly referred to as a “patch.” (Much of the

mechanics and terminology of electronic music hardware was inherited from the fields of telephony and radio from where the original sound generating and shaping circuitry came from.)

East Coast synthesizers tend to use 1/4" Phone plugs for interconnecting modules (some use the smaller, 1/8" phono plug variation to save space). These two-conductor patchcords are the same common connectors used in other audio equipment such as guitars, amplifiers, mixers, and so on. They have a further advantage in that the act of plugging or unplugging a patchcord on one of these systems may be able to activate an internal switch (called a "normal").

The Serge Modular uses patchcords that terminate in "banana plugs." These are single-conductor cords, as the ground is left internal to the system, rather than being "carried" along with each cord. They are the type of cords used in electronic test equipment. The banana plugs themselves are "stackable," meaning that the user can pull more than one line out from a single output jack, or connect multiple patchcords into one input jack without the use of a "Y" cable or "jack multiple" by pushing a plug into the back of another (there is also a hole in the side of each plug, as seen in the diagram below, into which another plug can be inserted, but this is less often used because of the limited space on the synthesizer panel). In a pinch, a longer cord can be made from two or more smaller cords by connecting them together.




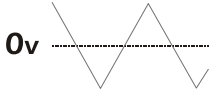





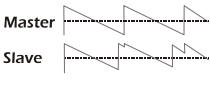
Heated debates have raged for years in the electronic music community over which method is best, but in my opinion after using both, the argument is easily put to rest: ¼" phone plugs are best for East Coast, high-level modules, and the stackable banana plugs are almost a *necessity* for the atomic functions of the Serge. That these two camps have different interconnection methods is almost a matter of natural selection. Patching the Serge sometimes feels more like running connections on an electronic engineer's proto-board than it does jacking a guitar into an effects pedal. Banana patchcords are unnecessary on a Moog, and using phono cords on a Serge-like system would quickly become unbearable. One type is not better than another—they are each perfectly suited to their different paradigms.

As with any system, it is beneficial to have handy an assortment of patchcords. These are available in many colors, and while the color scheme is electrically arbitrary, many find it helpful to use colors to denote cord length for the sake of organization and documentation. Others may try to color-code cords by function. Based on the cords purchased with the author's *Creature*, STS is using the color/length scheme below. Note that cable length in the table below is measured in inches and refers to the length of the actual *cable*, not including the length of the jacks on either end. The Pomona part numbers reflect "Model B (Banana)/Cable Length/Color of Insulator."

Insulator Color	Cable Length	Pomona Part #
Gray	4"	B-4-8
Green	8"	B-8-5
Yellow	12"	B-12-4
Red	18"	B-18-2
Blue	24"	B-24-6
Violet	36"	B-36-7
Brown	48"	B-48-1

Those familiar with other modular synthesizers may underestimate the number of patchcords required to make best use of a Serge system. Since many function blocks require intra-modular wiring in order to change that block's behavior. For one experienced with synthesis but new to the Serge, a rule of thumb might be to double or triple the number of cords you think you will need.

As for the jacks into which the patchcords are inserted, the flexibility of the Serge makes giving specific labels to these sometimes difficult, as each jack can often assume different functions depending upon how it is used. However, to help make their functionality a bit easier to work with, the Serge banana jacks are color-coded:

		Black—Bi-polar AC-coupled voltages and signal (voltages that may swing between positive and negative, as in an audio signal)
		Blue—Unipolar DC-coupled voltages (usually positive-only control voltages)
		Red—Logic (triggers, gates, and other positive-going pulses)
		Violet—Synchronization , currently found only on voltage-controlled oscillators so that one master oscillator may “retrigger” the waveforms of slave oscillators and help eliminate unwanted “beat frequencies.”

There is nothing that prevents the synthesist from using a gate as a control voltage, a signal as a gate, and so on. The jack colors are simply a handy convention to display the voltage range that jack provides or expects.

(The Serge has several colors of LED indicators, too, but I see no consistent reasoning behind their color-coding. The variety of colors may simply be for aesthetic purposes. In fact, the LED colors on my own *Creature* appear to be different than on others I've seen in photos.)

Serge Controls

Compared to most other synthesizers, Serge knobs are of a small diameter and are quite tall. This makes sense as the “high functional density” of the Serge demands that panel features are packed quite closely together, and the tall knobs aid in getting one’s fingers past stacked patchcords.

Unlike other synthesizers which tend to mark knobs with indications such as scales (1~10, -5~+5, etc.), the Serge uses a graphic system. One might argue that this is less “precise” than numeric indicators, but anyone who has used a modular synthesizer (and tried to document patches to paper) quickly realizes that precise reading of a knob is a lost cause—the tiniest movement of a particular knob can have a profound effect on the overall patch, and this effect is cumulative. Further, the knob settings of several otherwise identical modules will never land in precisely the same positions for a particular sound. One must always “tweak” a sound by feel and by ear, no matter how the knobs are demarked on paper.

In fact, the strength of the Serge indicators is that they inform the user graphically and at a glance as to their control range (positive, negative, or both), and keep the mind firmly in the “right brain” while creating a sound.



“0 – 100%” Attenuator



“Negative – to – Positive Attenuator”



“Crossfade”

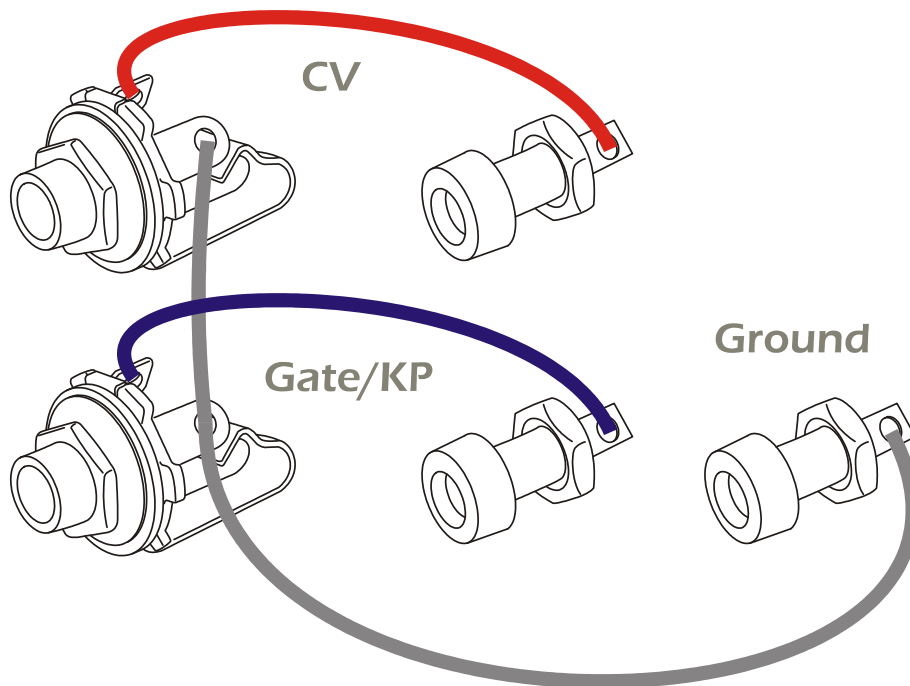


“Other”

Interfacing with Other Systems

The only real disadvantage of the Serge's use of banana cords is that it takes an extra step to interface the system with other equipment. Function blocks such as the X FADER on the *Creature* have a 1/4" phone jack for final output of the audio signal, but if you wish to connect a keyboard other than the TKB for instance, you will need to buy or make an adapter.

Below is a diagram showing how to wire 1/4" phone jacks to banana jacks. The "hot" lug of each phone jack is soldered to the single lug on the paired banana jack. The "ground" lug of every phone jack is tied together and to a single banana jack. Only two jack pairs are shown below but this scheme can easily be extended for as many jacks as you need (only one "ground" jack is required for the entire circuit no matter how many other jacks are added).



In use, the "ground" banana jack, if needed, is connected to the "ground" jack on the PS2A power supply.

The Creature

Getting Started

The *Creature* is an M-Class panel for the Serge Modular synthesizer system. On its own, it can make a variety of sounds, but as with any modular synthesizer, it becomes geometrically more powerful as more modules are added. The *Creature* is therefore a logical introduction to the Serge Modular synthesizer and a potential starting point for a larger system.

The *Creature* requires several items in order to function:

- A chassis in which to mount it
- A power supply
- Patchcords
- Headphones, or an amplifier and appropriate cables (usually a ¼" instrument cord)

The preferred chassis is the "M-Boat" offered by Sound Transform Systems. It is approximately 17" x 7" x 4.5" in dimension (not counting the rubber 'feet') and is large enough to hold two M-Modules. M-Boats are twice the depth of the cases which hold the Serge Touch Keyboard. Optional rack ears may be purchased for fitting the M-Boat into a standard 19-inch equipment rack. M-Boats have a central power/indicator panel (sometimes called the "Obelisk") which has LED indicators for +12/-12v, as well as a power LED. If a control voltage is plugged into the jack below this power indicator, the indicator becomes a visual "voltage indicator," glowing more brightly with higher voltages. Mounted to the back of this center panel is a power distribution board with enough connectors to service 4 M-Modules.

The Serge PS2A power supply is an inline AC/DC converter with a grounded AC wall cord at one end and a Molex connector at the other designed to mate with the distribution board inside the "M-Boat." It provides enough power for two full Serge panels or four M-Class modules.

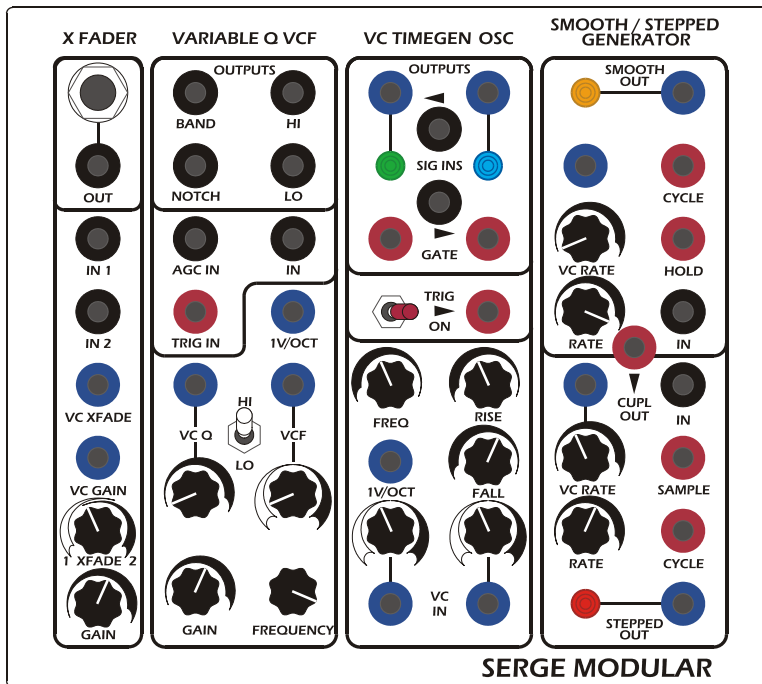
Sound Transform Systems sells patchcords in sets of ten pieces. There is a “long” and a “short” set, each with several varying lengths of patchcord. The recommendation for a single *Creature* panel is two sets of “short” cords, twenty cords in all.

STS most likely shipped your *Creature* already mounted in the M-Boat with the power connector in place. To provide power to the M-Boat, remove the power supply from its packaging and feed the Molex connector end in through the pass-through hole in the back of the M-Boat. Connect the power supply to the connector.

Remove the patchcords from their individual packaging.

The Panel

The *Creature* is a single 7-7/8” x 7” panel with four Serge function blocks:

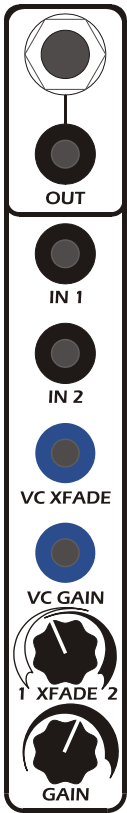


Let's examine each block individually before connecting them together.

Cross-Fader

In a system consisting of only a *Creature*, the Cross-Fader (“XFAD”) module will most likely be used as an output module. It functions both as a 2-input voltage-controlled mixer and a voltage-controlled output amplifier and includes a 1/4" phone jack. This phone jack can be used to connect the panel with standard amplifiers and mixers, and also has enough power to drive a pair of headphones.

X FADER



The Cross-Fader has two inputs which are mixed together and appear at the output(s).

The amount of each signal is controlled by the XFADE control. Turning this control counter-clockwise increases the amount of IN 1 appearing at the output and decreases the amount of IN 2; rotating the control clockwise has the opposite effect.

Control voltage fed into the VC XFADE jack also affects this mix, with lower voltages favoring the IN 1 signal and higher voltages the IN 2.

Amplitude of the overall output is controlled using the GAIN knob, and control voltages patched into the VC GAIN jack will additively affect this level, with higher voltages producing higher gain.

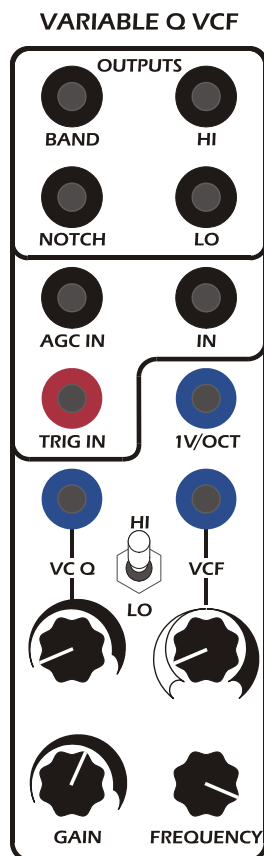
Used as an output module: Patch an audio signal into either input (e.g., IN 1). Rotate the XFADE knob all the way to one extreme (e.g., counter-clockwise to IN 1). Patch the OUT jack to an external mixer or amplifier. Use the GAIN knob to control the overall level.

Used as a voltage-controlled amplifier: Patch it as above, but rotate the GAIN knob all the way CCW. Patch a control voltage into the VC GAIN. The level of the output signal will now respond to the control voltage for tremolo or amplitude envelope shaping.

Used as a cross-fader: With two different inputs patched in, a control voltage at the VC XFADE will smoothly fade between them.

Variable Q Voltage-Controlled Filter

The “VCFQ” is a voltage-controlled filter with four different simultaneous responses (Band-pass, High-pass, Notch, and Low-pass). The slope is 12 db/octave for the HI and LO outputs; 6 db/octave for BAND and NOTCH.



The 'center frequency'/'frequency of interest' of the filter is controlled manually with the FREQUENCY control or via voltage-control by patching a CV into the VCF jack. The CV's strength and phase (i.e., positive or inverted) is adjusted using the VCF knob.

A second control input labeled 1V/OCT is also provided, specifically designed to move the center frequency of the filter one octave for every volt and is useful for causing the filter to track the pitch of a note by patching a keyboard's pitch CV in here as well.

The filter's "Q" (also called 'resonance'/'emphasis') is varied by patching a control voltage into the VC Q jack; the associated knob adjusts the strength of that voltage. "Q" is a routing of some of the output signal back into the input of the filter. It has the very noticeable effect of accentuating the portion of the audio spectrum near the frequency of interest.

Two different inputs are available. The initial level of a signal patched into the IN jack is controlled by the GAIN knob. The AGC IN jack is not affected by GAIN but rather feeds into an automatic gain control. Using this input holds the output level constant and prevents the module from overloading; this is particularly useful when using high “Q” settings.

The filter may be switched between a “HI” range (audio) and “LO” (sub-audio, CV). The TRIG IN jack accepts a pulse which drives the filter to ‘damped ringing,’ the timbre of which is dependent on the frequency and Q settings.

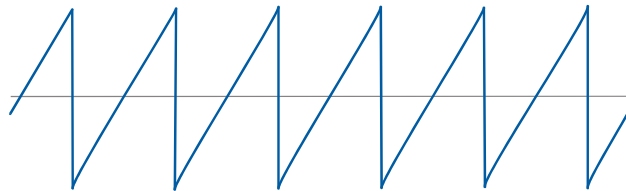
The filter can be driven into self-oscillation, but only by patching the BAND output back to the IN jack.

Voltage-Controlled TimeGen Oscillator

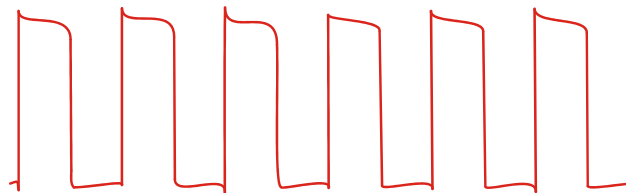
The “TGO” is a uniquely ‘Serge’ function block. It can function as a wide-range waveform generator, envelope follower, non-linear low-pass filter, linear or exponential glide processor, attack-release contour generator, a low-frequency oscillator... as with many Serge modules, the list goes on.

Even though the elements of this function block are graphically grouped as “Inputs/Outputs,” “Trigger,” and “Control,” it’s helpful to divide it first into a “left” and a “right” section. The left section is generally thought of as a wide-range audio oscillator, while the right-side provides a variety of control functions, like several signature Serge modules through voltage-controlled lag integration. Let’s examine the left-side first:

The left OUTPUT [blue] jack produces a ramp waveform (aka “reverse Sawtooth”). An LED visually indicates the voltage level.



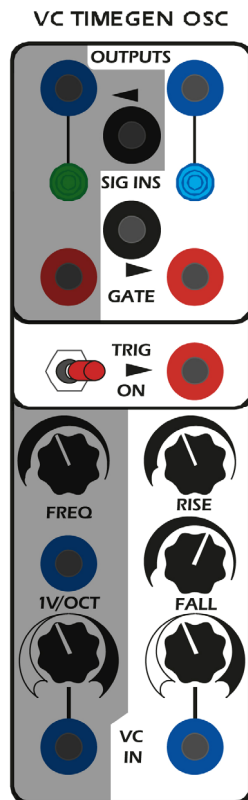
The left GATE [red] jack outputs a 50% duty cycle square waveform.



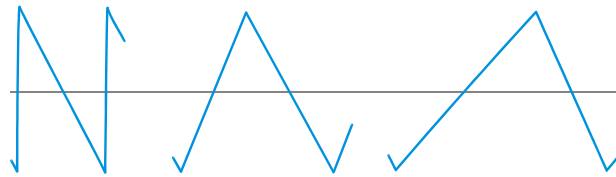
The pitch of these outputs is determined by the jacks and knobs below: FREQ sets the initial frequency, 1V/OCT accepts a control voltage, raising the frequency one volt per octave, and the VC jack and knob accept and adjust a frequency modulation CV.



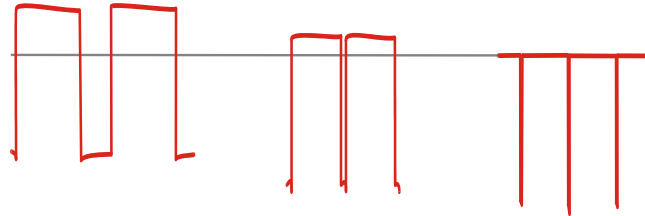
The right-side of the TGO functions independently of the left:



The right OUTPUT [blue] jack offers a triangular waveform whose symmetry can be adjusted from sawtooth to triangle to ramp by settings of the lower section. An LED visually indicates the voltage level. Some examples:



The right GATE [red] jack produces a rectangular (pulse) waveform whose frequency and duty cycle are adjusted (and voltage-controllable) by the same four lower controls. Note that as the duty cycle reaches its extremes, a strong DC component enters the output:



The center section of this function block contains enables/disables the right-side functions. With the toggle switch flipped to the right, the circuitry is turned on. When the switch is flipped to the left, the circuitry is disabled unless a voltage pulse at the associated TRIG ON jack goes high.

The wave shapes of the TGO's right-side, as well as the pitch, are interactively decided by the four controls in the bottom section. The RISE knob sets the rate at which the output waveform at the blue jack rises, and the FALL knob, the rate of the fall. Slower rates lower the overall frequency, and faster raise it. (The *red* jack's slopes are not affected, but the duty cycle is.) A control voltage at the VC jack (and its attenuator) affect both equally.

The SMOOTH/STEPPED GENERATOR

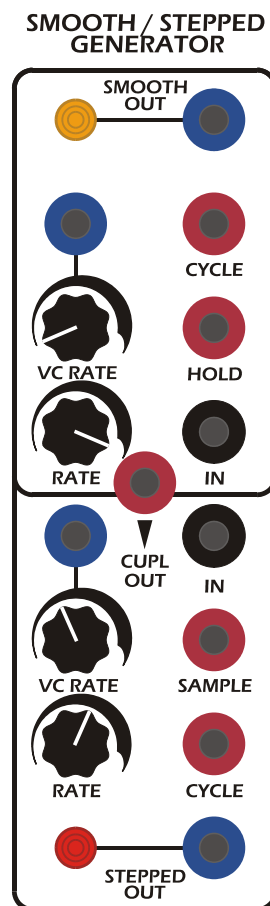
The “SSG” is another distinctively Serge module. As with the TGO, understanding it is best accomplished by examining it in sections.

The top half is the “smooth” function generator, a voltage-controlled lag integrator which can also act as a track-and-hold circuit, and can be patched to retrigger itself for LFO functions. It has a black IN jack and a blue SMOOTH OUT jack with an associated LED whose brightness reflects the voltage level of the output. The RATE knob manually controls lag applied to the rise and fall of the input voltage. Voltage applied to the VC RATE input jack (through the attenuator knob) also affects the lag rate.

Using these basic functions, the module can process a keyboard voltage to create portamento/glide, it can process a gate to create an AR envelope, and other such functions.

The red CYCLE jack outputs a pulse which goes high at the end of a cycle. By patching it back into the input, the Smooth Generator oscillates and becomes a useful LFO. The CYCLE jack outputs a pulse stream at the same frequency as the triangular waveform of the SMOOTH OUT jack.

A pulse going high at the HOLD jack will freeze the output voltage at the level it was at the instant when the pulse went high. The output voltage will resume tracking once this HOLD pulse goes low again. (This is known as ‘track-and-hold.’) HOLD also works while the function block is patched as an LFO.



The lower half of the SSG is the Stepped Generator. It too has an IN jack, and also a STEPPED OUT jack and associated LED. In general, this section is a sample-and-hold module: when a pulse at the SAMPLE jack goes high,

the voltage at the output jack is held until the SAMPLE pulse falls and goes high again. It is similar to the track-and-hold of the upper module except that the STEPPED OUT changes in discreet steps and does not continuously vary (track).

By patching the CYCLE jack back into the IN jack and applying pulses to the IN jack, this function block produces a continuous 'staircase' voltage contour at its output.

The RATE knob adjusts the amount of 'difference' in voltage from one step of the output to the next. At high settings, the stepped output varies little ("high correlation"); at lower settings, the steps may vary widely. Voltage patched into the VC RATE jack and adjusted with its attenuator also affects this serial correlation.

The top and bottom halves of this module are independent of each other with the exception of the red CUPL OUT jack. This is the output of an internal comparator that monitors and compares the outputs of the two module halves. If the voltage level of the Stepped Generator is higher than that of the Smooth section, the output of CUPL OUT goes high; otherwise, its output voltage is low.

(Earlier versions of the SSG produced a very "hot" +/-10v output at the coupler output. The modified SSG included in the *Creature* has a 0v~+6v swing which makes it easier to use as a possible audio signal within the Serge system.)

Sample Patches

The patches on the following pages are not intended to be final sound programs, ready for musical use. Instead, they are a series of tutorial configurations designed to unveil a few of the hidden secrets in the *Creature* panel. Many of the following patches build upon the previous example, so it is best to try these patches in order. These patches in no way demonstrate all of the possible functions of the *Creature*—they are simply presented as a tutorial to get you started with the panel’s unfamiliar functions blocks.

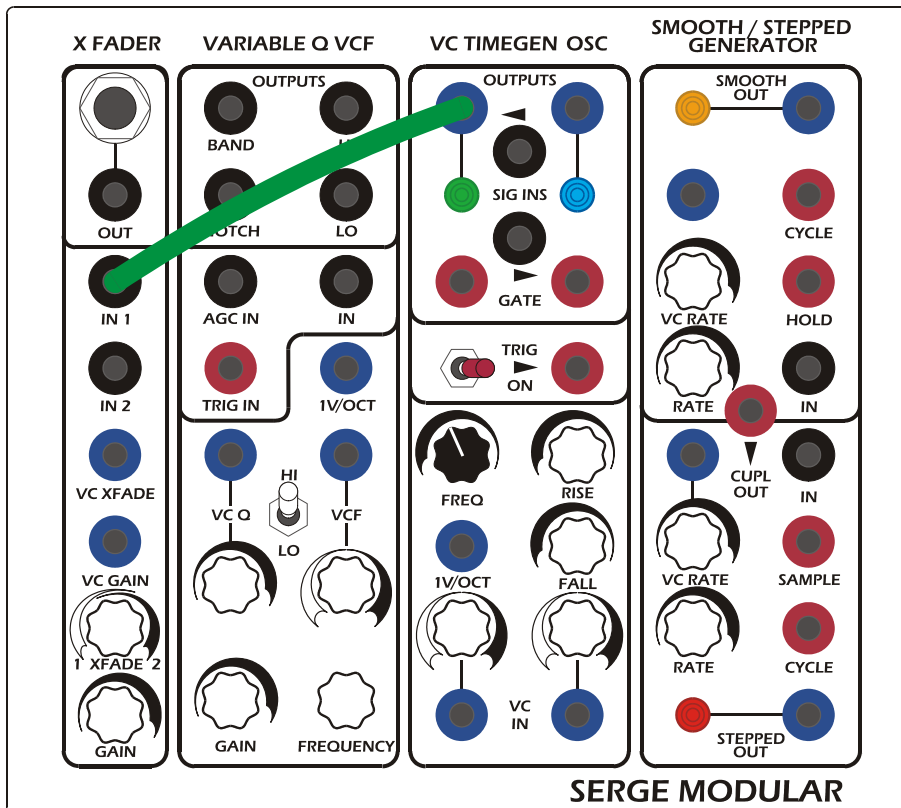
Any colored patchcord may be used to recreate these patches. However, the diagrams generally make good use of the standard STS patchcord color scheme as described in the “Patching the Serge” section, previous.

Be sure to patch any voltage about which you are curious into the black jack on the Obelisk panel so that you can fully understand its behavior.

Where control input from a keyboard is shown, the Serge Touch Activated Keyboard Sequencer (“TKB”) is shown, but other keyboards and controllers may be substituted. Only the Key Voltage (“KV”) and Key Pulse (“KP” aka ‘gate’) of the TKB are used here.

In all of the following patch diagrams, a connection from the output of the Cross-Fader to an amplifier or headphones is presumed, but omitted for clarity.

Sawtooth Waveform from the TGO



Turn the “GAIN” knob on the XFAD all the way to the left.

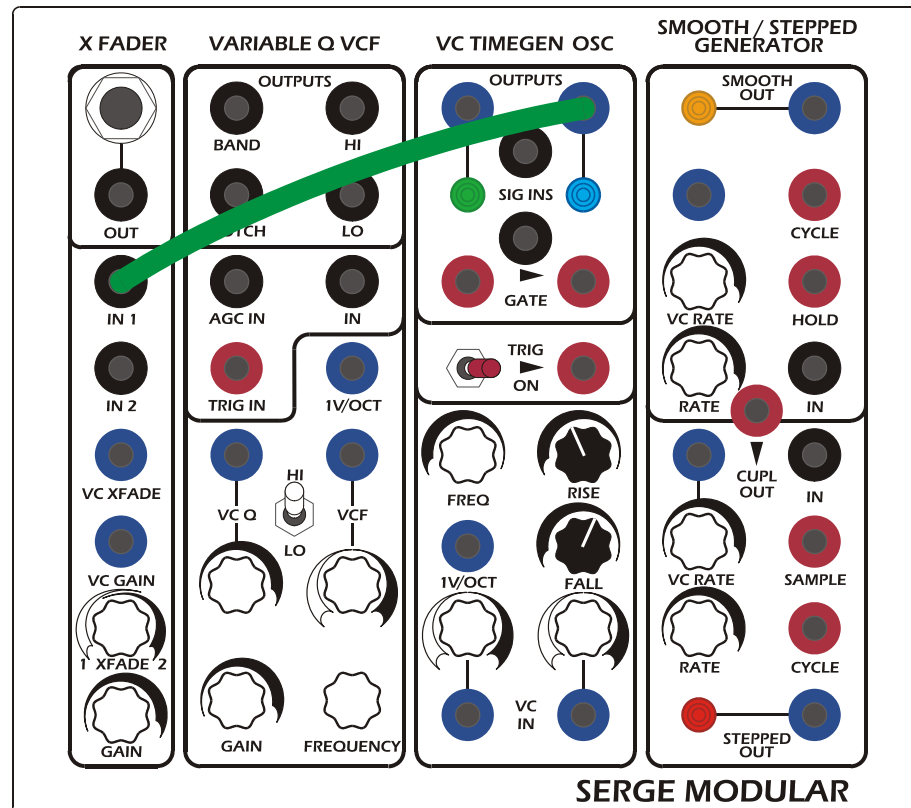
Connect the left blue “OUTPUT” of the TGO to “IN 1” of the XFAD.

Turn the “XFADE” knob of the XFAD function block all the way left to “1.”

With the “OUT” of the XFAD connected to headphones or an amplifier, slowly turn the XFAD’s “GAIN” knob clockwise until you can hear the sawtooth wave. If you cannot hear it, the frequency of the tone may be outside the audible range. In this case, try adjusting the “FREQ” knob of the TGO.

In this configuration, the TGO’s “FREQ” knob is the only manual control that will have any noticeable effect on the sound.

Triangular Waveform from the TGO



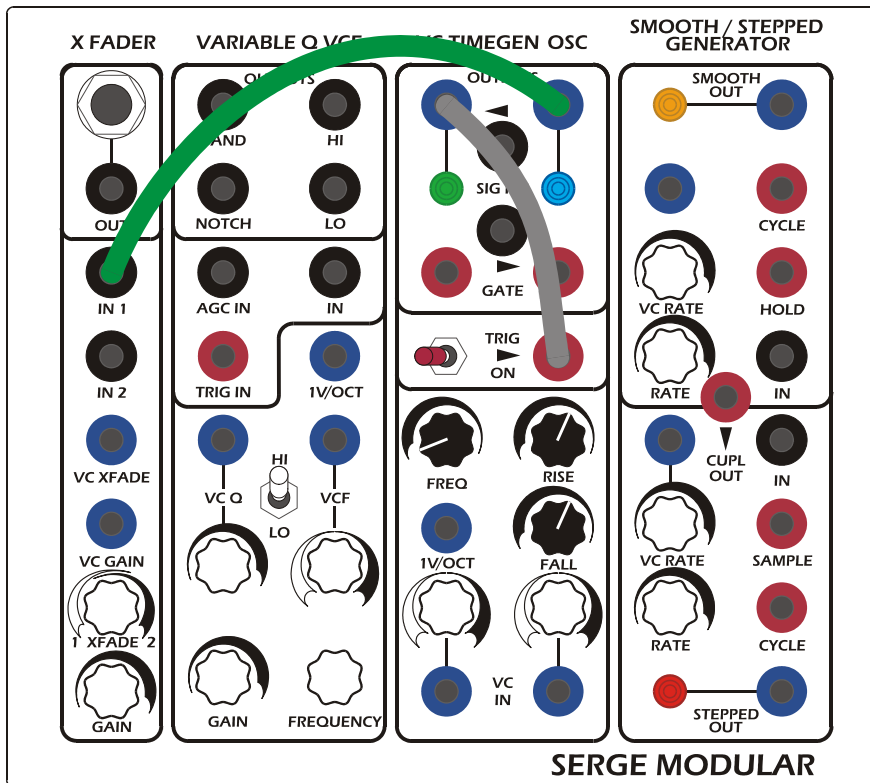
Set up the patch as previous, but use the right blue TGO “OUTPUT” jack instead of the left one.

Initially, you may not hear any sound depending on the positions of the TGO’s switch and two knobs.

Flick the TGO’s “TRIG ON” Switch to the right. This switch (or a high voltage at the red jack next to it) enables the right-side features of the TGO.

The right side of the TGO is not controlled by the “FREQ” knob. Instead, alter the pitch and the waveshape of the tone by adjusting the “RISE” and “FALL” knobs. With both at 12:00, the waveform is triangular. Moving the knobs clockwise increases pitch but skews the wave shape left or right.

Exploring the TGO's Trigger

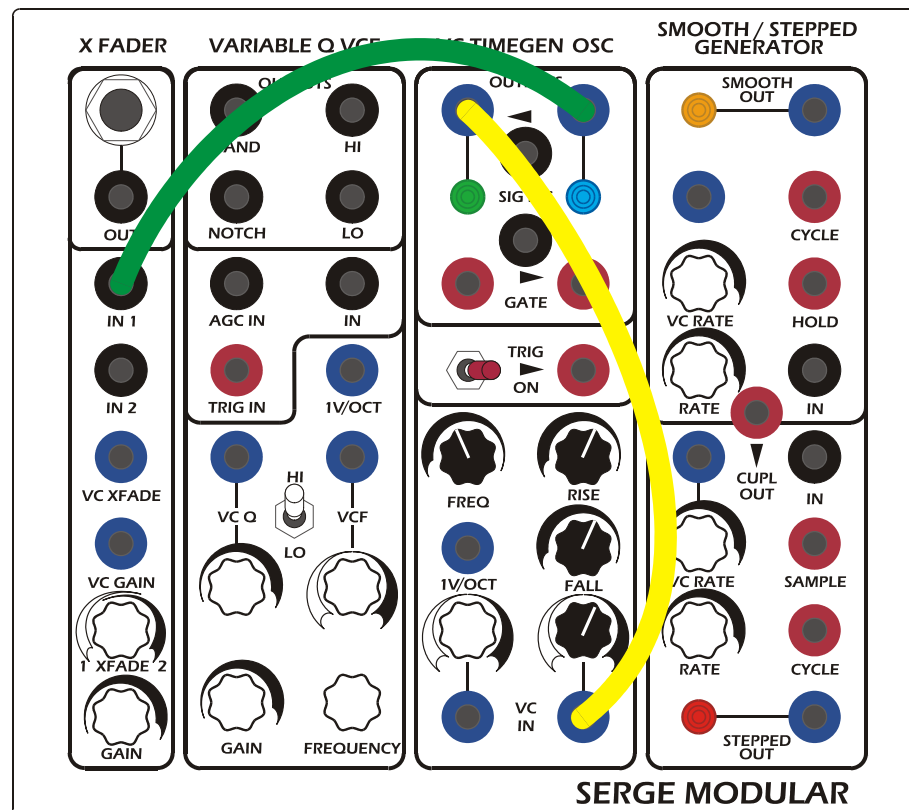


Set up the patch as previous, but flick the “TRIG ON” switch to the left, ‘off’ position. This disables the right side of the TGO.

Now we’ll use the *left* side oscillator of the TGO as an LFO to electronically enable/disable the *right* side. Set up the patch as shown in the illustration above. With the “FREQ” knob set low, the left LED shows it oscillating only a few cycles per second, in low-frequency oscillator range. When the “TRIG” switch is ‘off,’ the output of the left-side TGO cyclically enables/disables the right-side. Turning the “FREQ” knob up raises the pitch of the controlling oscillator and interesting modulation occurs.

Note: it seems to be possible in complex patches to drive the right-side of the TGO into a shut-down state that voltage triggers cannot re-enable. To ‘clear’ this, move the switch off and then on again. This usually clears the ‘lock-out.’

Frequency Modulation



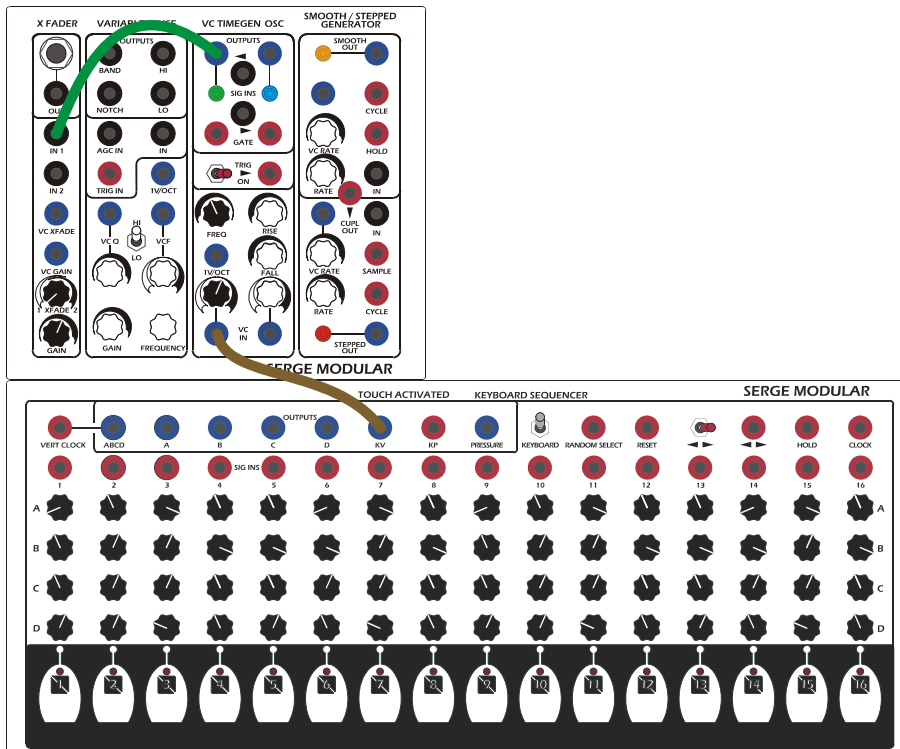
Set up the patch as previous.

Instead of having the left-side control the enabling of the right-side, we will now have the left frequency-modulate (“FM”) the right.

Switch the “TRIG ON” to ‘on’ to enable the right-side of the TGO.

Replace the last patchcord with a new one that goes into the right “VC IN” jack. Turn the associated knob into its positive range. Now as you adjust the “FREQ,” “RISE,” and/or “FALL” knobs, you will hear interesting harmonics created by FM.

Control the Pitch of the TGO from a Keyboard

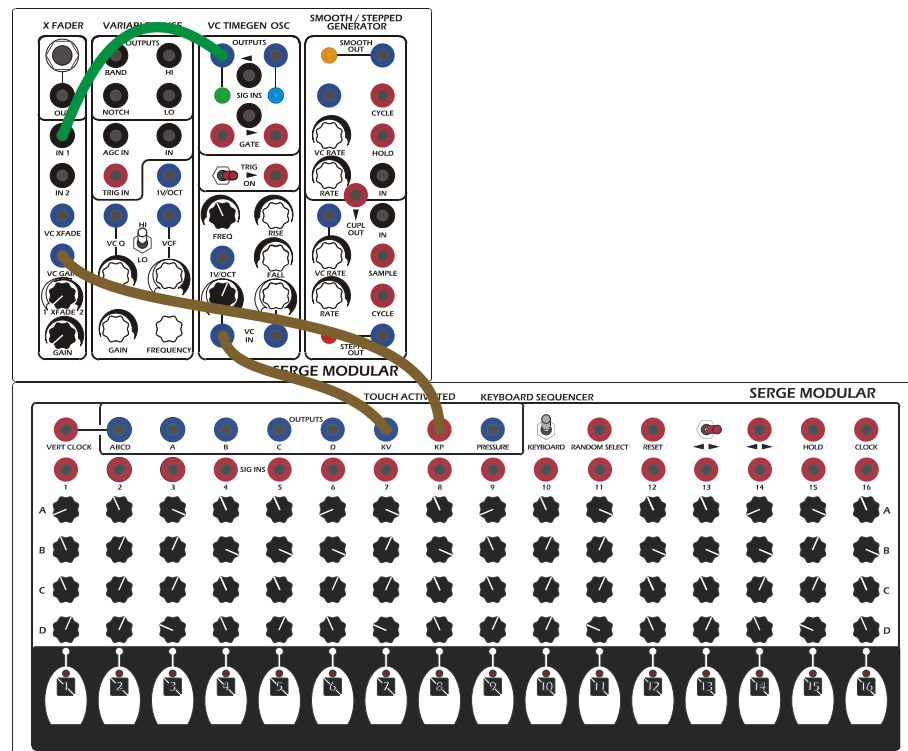


Let's get the TGO under keyboard control. Patch the *Creature* to create a sawtooth waveform as in the first example.

If you are using a keyboard other than the Serge TKB, patch its CV output into the TGO's "1V/OCT" input. If you are using the TKB, however, patch the Keyboard Voltage ("KV") from that unit into the TGO's left "VC IN" blue jack. The reason for the difference is that the TKB's "KV" jack produces equally-spaced voltages per key, but in greater increments than the 1/12th-volt per octave of other keyboards. This allows experimentation with other equal-tempered tunings, but we must use the attenuator on the TGO to dial-in the 12-notes-per-octave of the chromatic scale. A setting just under 1:00 on that knob does the trick.

By playing keys on the keyboard or turning the TGO's "FREQ" knob, you can tune and change the pitch of the tone.

Add a Simple Envelope



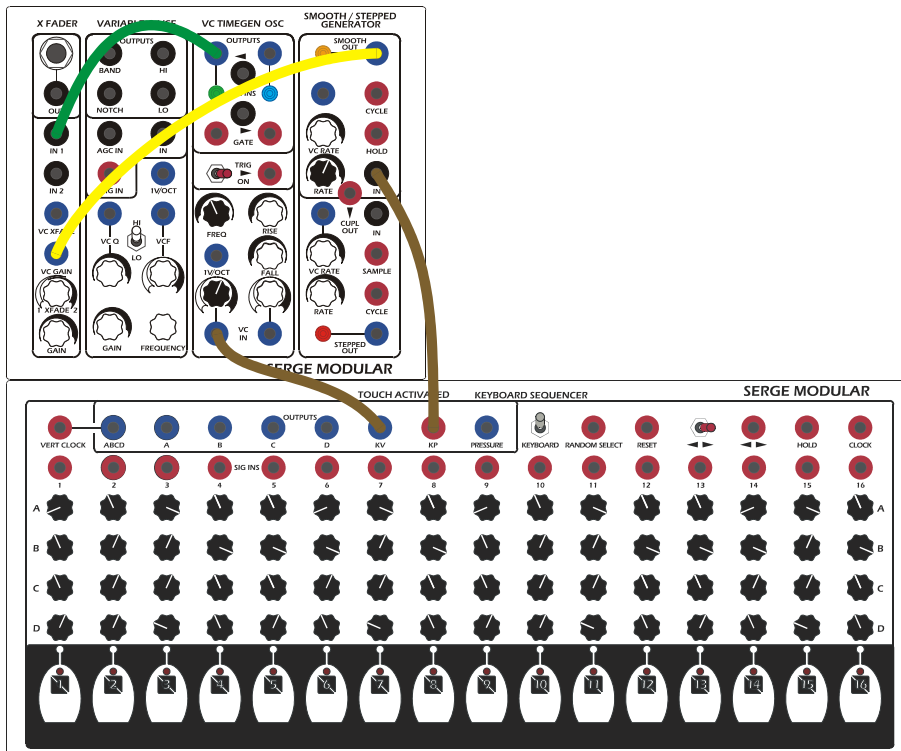
Set up the patch as in the prior example.

Turn the XFAD's "GAIN" knob all the way to the left so that there is no sound. We will use the XFAD as a VCA now to control note duration. Patch the Gate from the keyboard into the XFAD's "VC GAIN" blue input jack. On the Serge TKB, the gate voltage is called 'Keyboard Pulse' and is labeled "KP."

Play a few notes. Now the *Creature* only produces tones when the keys are activated. Pressing a key produces an almost instantaneous high voltage as the gate/pulse raises the gain of the XFAD, using it as a VCA. The amplitude drops as quickly when the key is released.

Try using the TKB's "PRESSURE" output instead of the "KP" and ease the XFAD's "GAIN" knob to the 9:00 position. You can now control the gain of the envelope by the pressure of your finger on the keys.

Simple Envelope Shaping

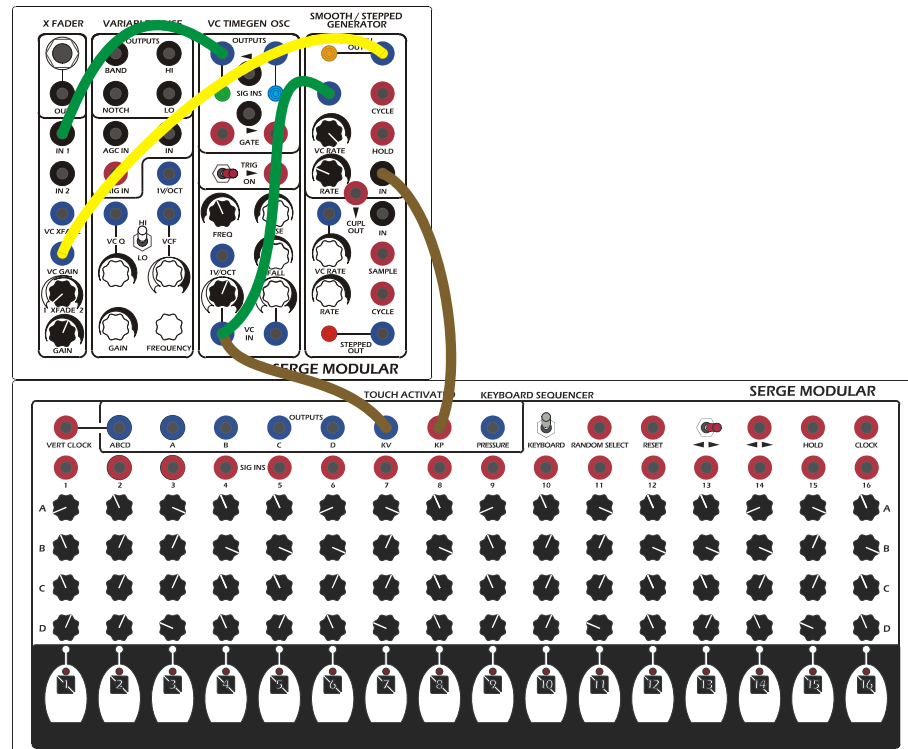


Set up the patch as in the prior example.

Instead of patching the KP (gate) from the keyboard directly into the XFAD, move that patchcord to the black “IN” jack of the SSG and add a new patchcord from the SSG “SMOOTH OUT” jack into the XFAD’s “VC GAIN” jack.

As you play notes on the keyboard, adjust the SSG’s “RATE” knob and listen to the amplitude envelope change character. We are here using the SSG as a ‘slew’ or ‘lag’ function to soften the rise and fall of the raw gate pulse. It is being used as an AR envelope generator. However, the ‘attack’ and ‘release’ of the envelope are always symmetrical.

Voltage-Controlled Envelope Shaping



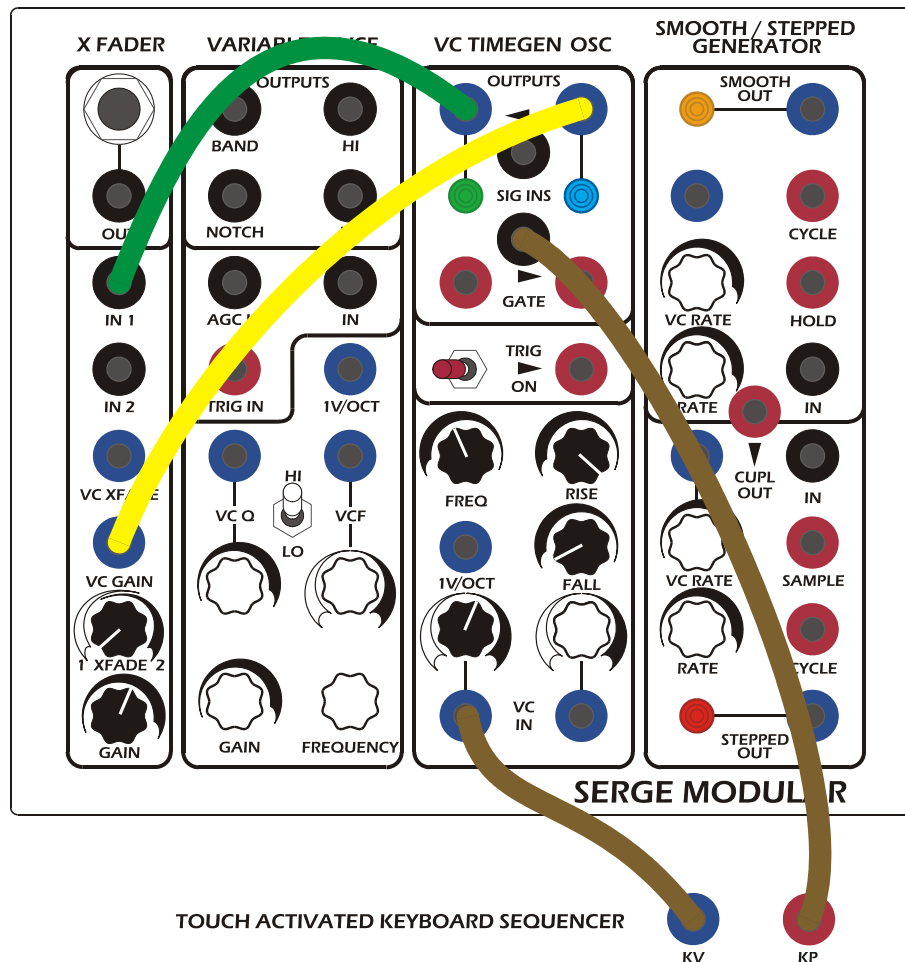
Set up the patch as in the prior example.

Add a new patchcord: plug one end into the back of the cord jacked into the TGO's left "VC IN" jack. Doing this is the same as jacking it into the TKB's "KV" jack but is shorter and neater. The other end should be plugged into the SSG's top, blue "VC RATE" jack.

Turn the “VC RATE” knob all the way up to get the full effect of the keyboard’s voltage on the envelope rate. Carefully adjust the topmost “RATE” knob underneath it while playing keys up and down the keyboard. Notice how the higher notes have shorter envelopes and the lower notes have lengthy attack & release phases.

Play each note distinctly, since the attack phase of each note starts from the position of the release phase of the previous note.

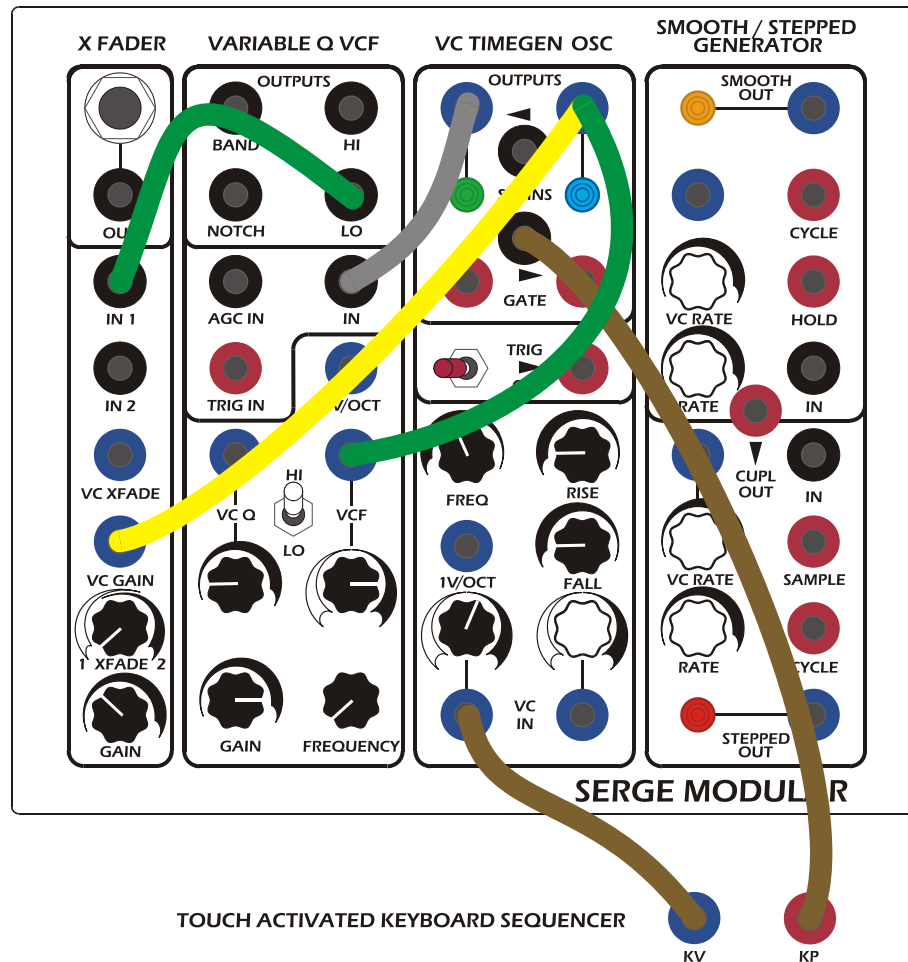
A More Useful AR Envelope



Set up the patch as in the illustration above. This time, we will use the right-side of the TGO as an AR generator rather than the SSG. The “RISE” and “FALL” knobs of the TGO can adjust the attack and decay (respectively) independent of each other.

Notice that we are patching the TKB’s KP (gate) into the TGO’s “SIGNAL IN” rather than the “TRIG ON” jack we explored earlier. In fact, both will work, but using the “SIG IN” allows re-triggering of the envelope. Try both options!

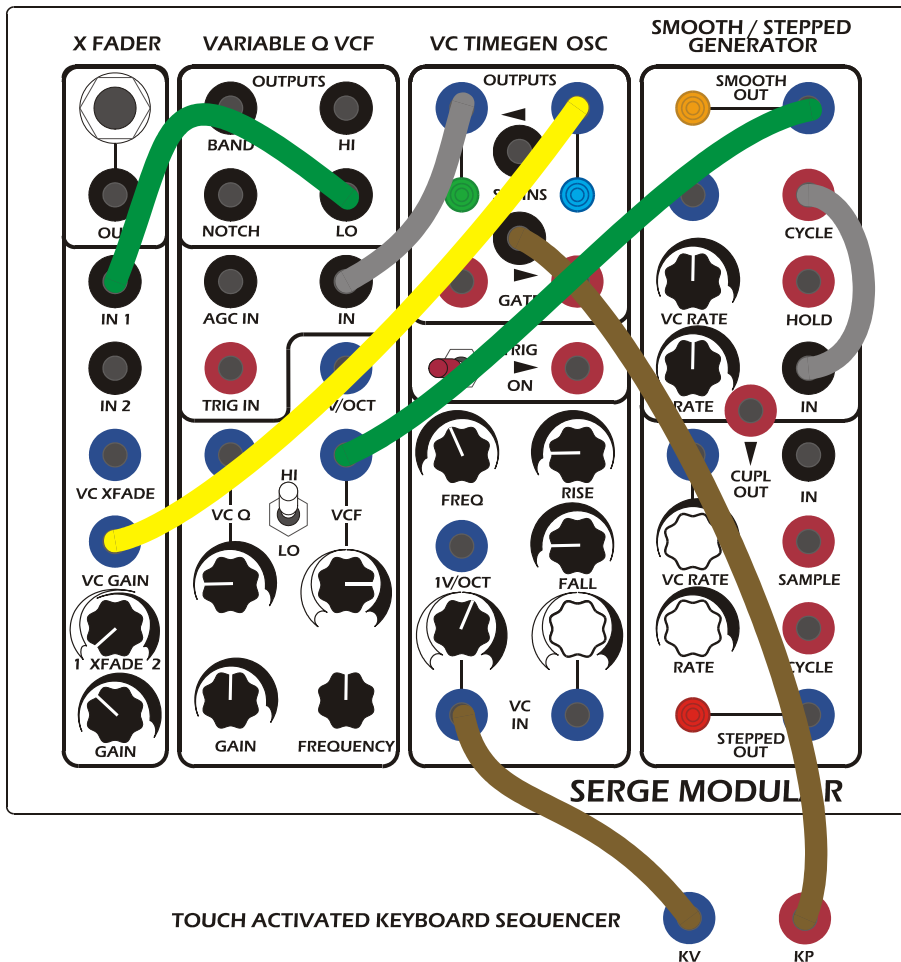
Voltage Controlled Filtering



Patch the Variable Q VCF in as a Lowpass filter as shown above. Adjust the “VC Q” knob so that you can clearly hear an ‘edge’ to the filtering effect as you move the VCFQ’s “FREQUENCY” knob.

Adjust the “RISE” and “FALL” knobs of the TGO so that the envelope, which is here controlling both the amplitude of the sound and the cutoff frequency of the filter, is soft enough to allow you to hear the filtering effect.

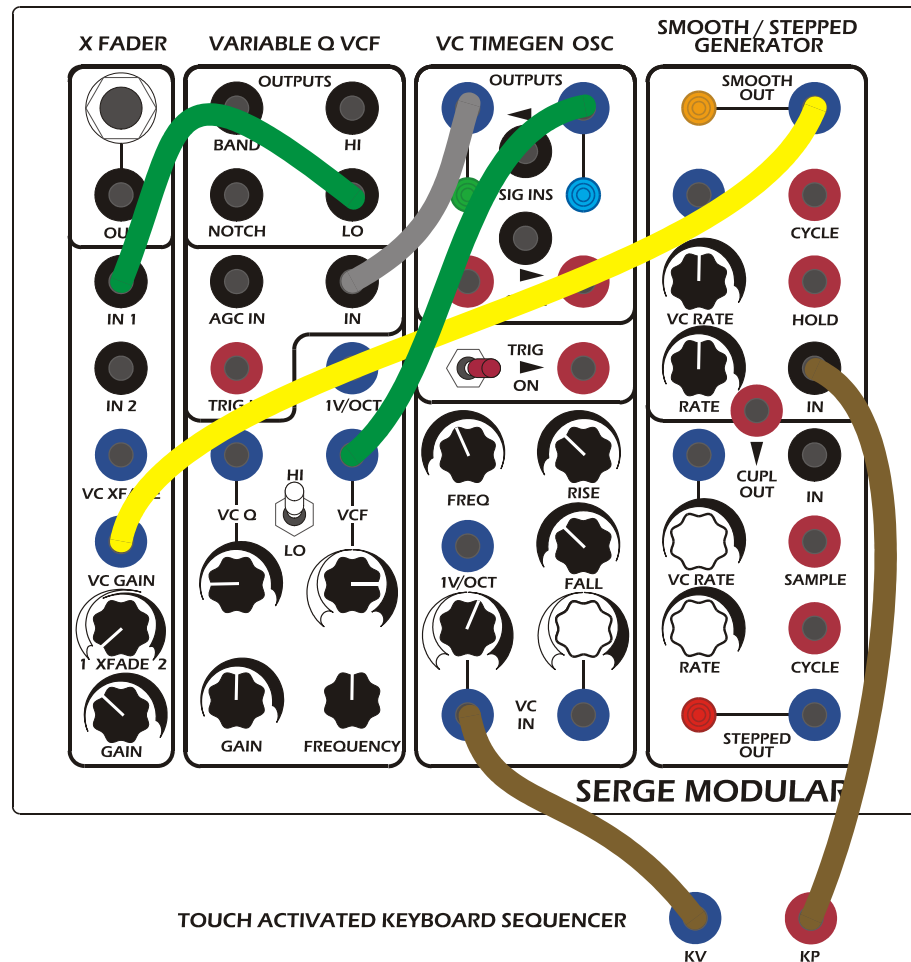
The SSG as an LFO / A Complete Synthesizer 'Voice'



In the patch above, the SSG is wired as an LFO by connecting the "CYCLE" jack into the "IN" jack. This LFO is controlling the cutoff frequency of the filter producing a constant tremolo-like effect.

This patch is a complete, 'traditional' synthesizer voice: There is a VCO (the TGO) sending signal into a VCF (the VCFQ), and then into a VCA (the XFAD). An EG (the TGO) controls the VCA and an LFO (the SSG) modulates the filter.

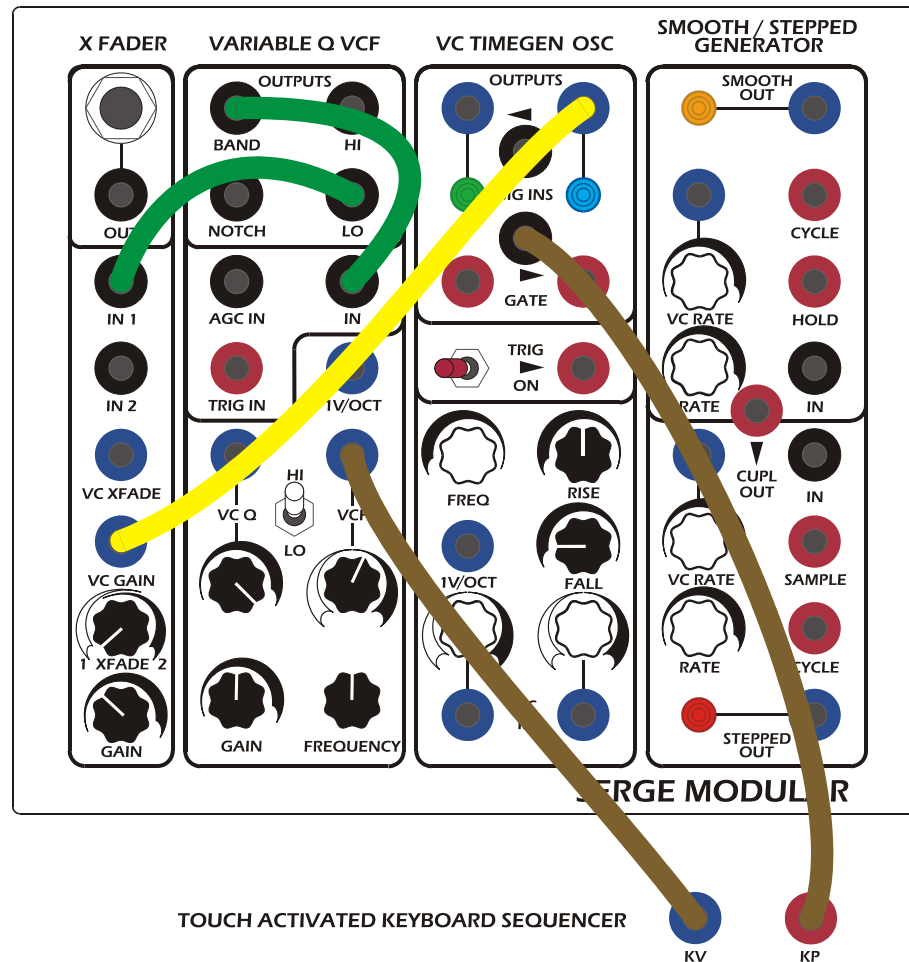
The TGO as an LFO



This patch achieves the same goals as the previous one, but in this case we swap the right-side of the TGO and the SSG. The TGO now acts as the filter's LFO. By adjusting the "RISE" and "FALL" controls of the TGO, wave shapes other than the triangle of the SSG are produced. The SSG fills the role of envelope generator here, with symmetrical attack and release times.

This demonstrates how a particular synthesizer task may be coaxed out of different function blocks.

The VCFQ as a VCO

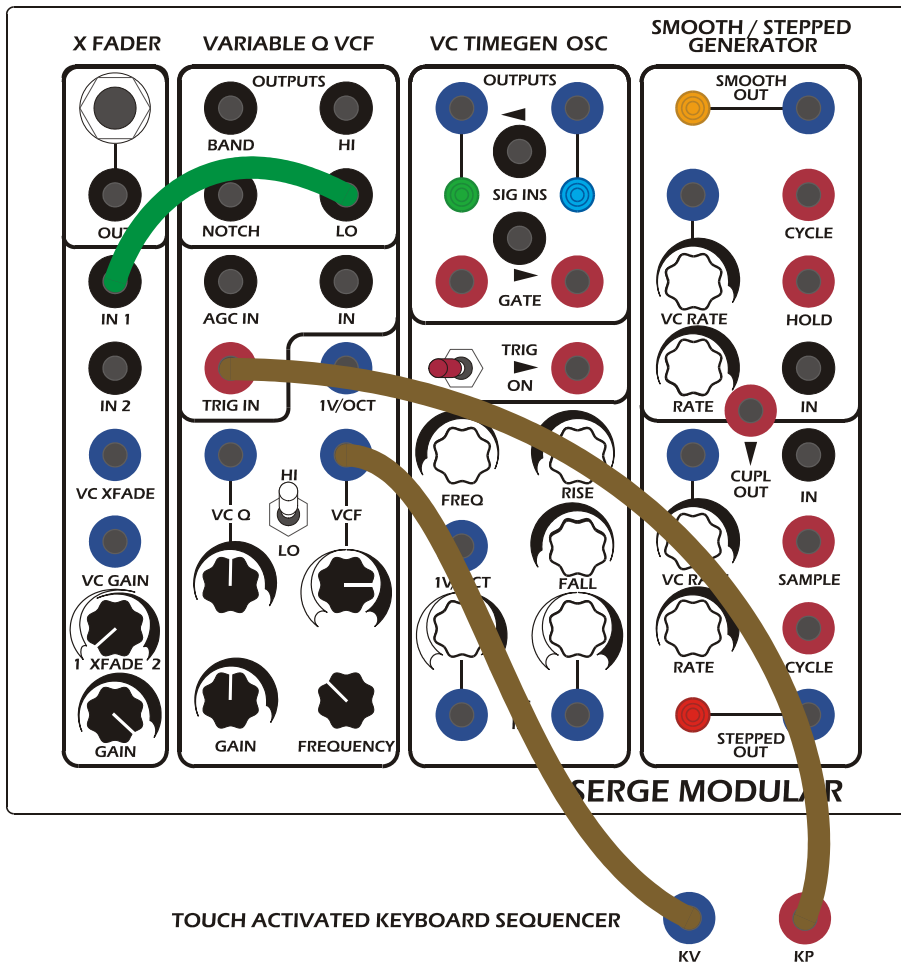


The VCFQ can be used as a voltage-controlled oscillator by driving it into self-oscillation. This is accomplished by patching the bandpass output back to the input, and turning the Q to maximum.

The pitch can be controlled by the “FREQUENCY” knob, and/or by patching a control voltage into the “VCF” and/or “1V/OCT” jacks.

A tone may be pulled from any of the filter’s four outputs.

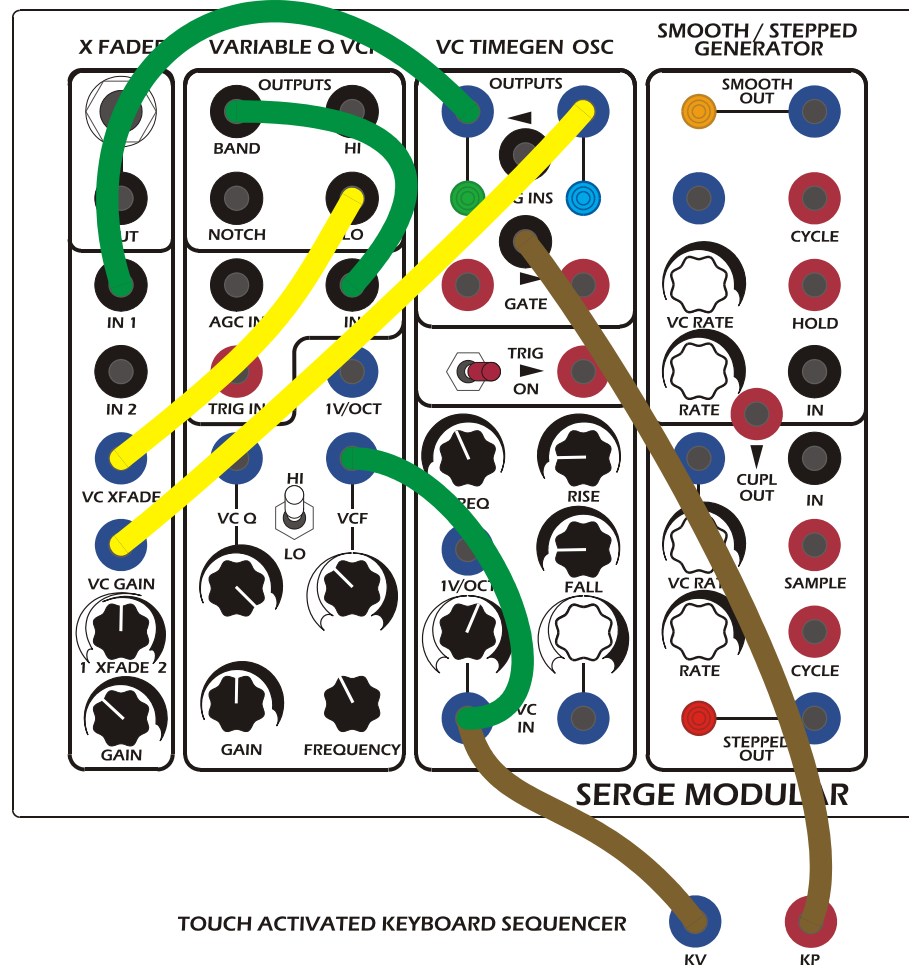
The VCFQ as Analog Drum Voice



This patch uses a pulse to drive the VCFQ into 'damped ringing,' a technique used by early drum machines for tom and wood block sounds. Notice we aren't using any envelope shaping (though we could) because damped ringing by nature has a percussive envelope.

Adjust the filter knobs and try different VCFQ outputs to explore different tones.

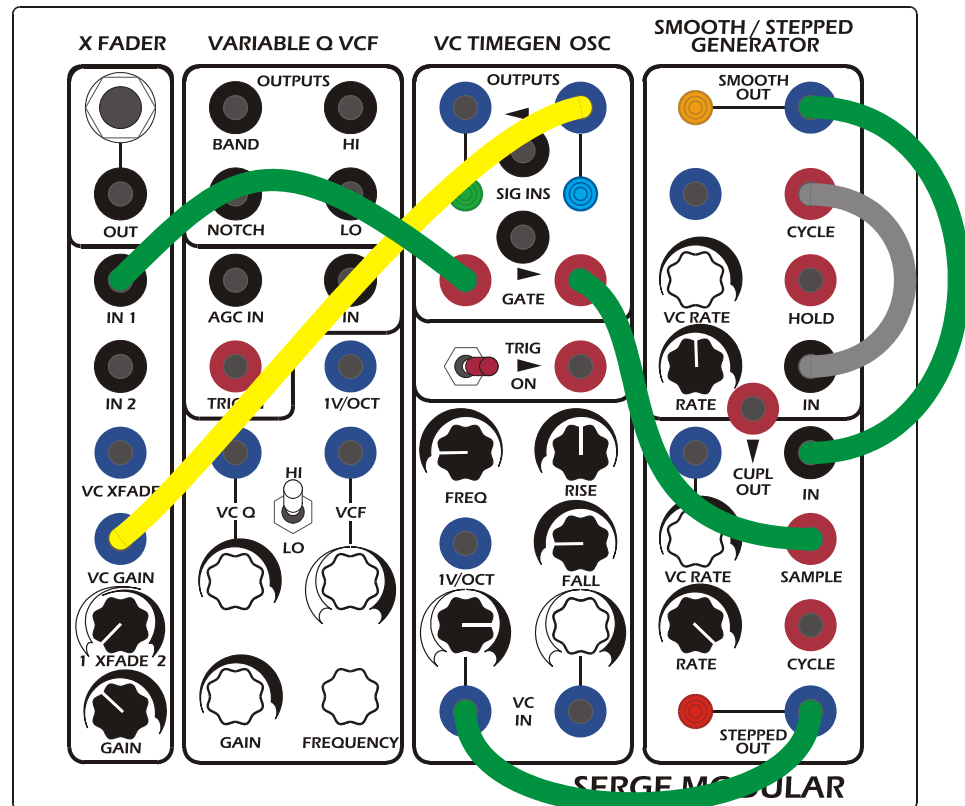
Gritty Amplitude Modulation



The patch shown above uses the VCFQ as an oscillator, tracking the keyboard along with the TGO. It is not being used as a direct audio oscillator, however. Rather it is amplitude modulating the TGO's envelope by using the XFAD's "VC XFAD" control input.

Of course, the VCFQ *could* be used as a second VCO, just remove the patchcord from the "VC XFAD" input, insert it into the "IN 2" jack above it, and adjust the "XFAD" and the "VCF" knobs for tuning and balance.

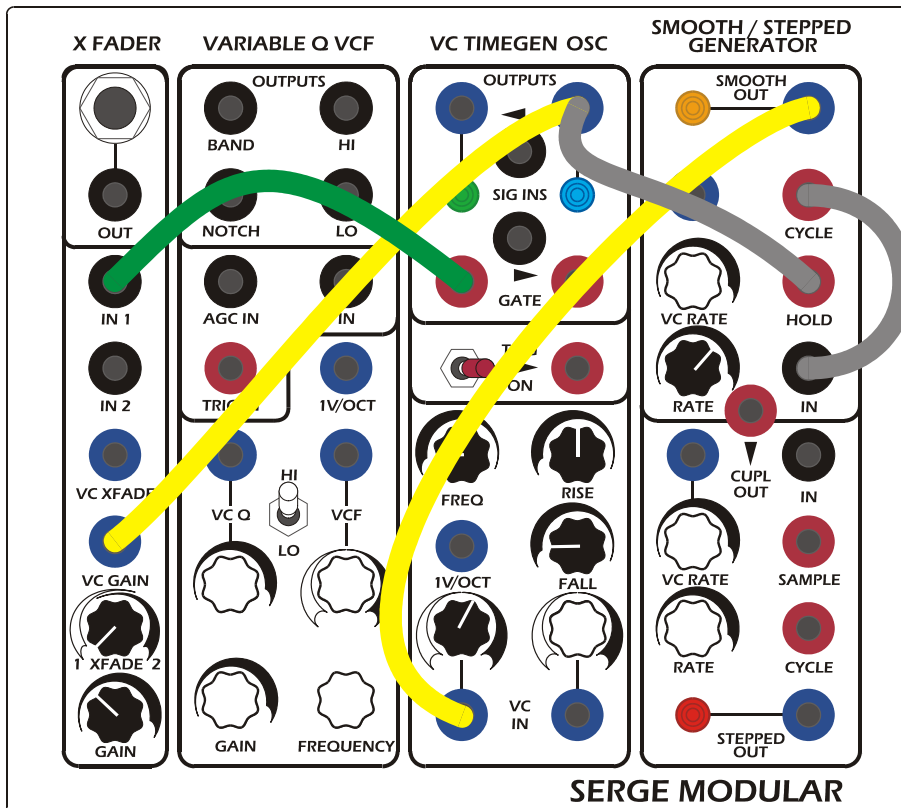
The SSG Track and Hold



In this patch, the top half of the SSG is wired to create a slowly changing LFO. This is patched into the bottom half, which will sample the voltage and use it to control the frequency of the left-side of the TGO. The right side of the TGO is set up as a second LFO. Each time this second LFO oscillates, it triggers a new sampling in the sample and hold (as well as providing an envelope for the sound). The end result is an evenly-timed series of randomly-pitched tones. Try adjusting the various knobs involved. The SSG's lower "RATE" knob adjusts the correlation of the sample & hold.

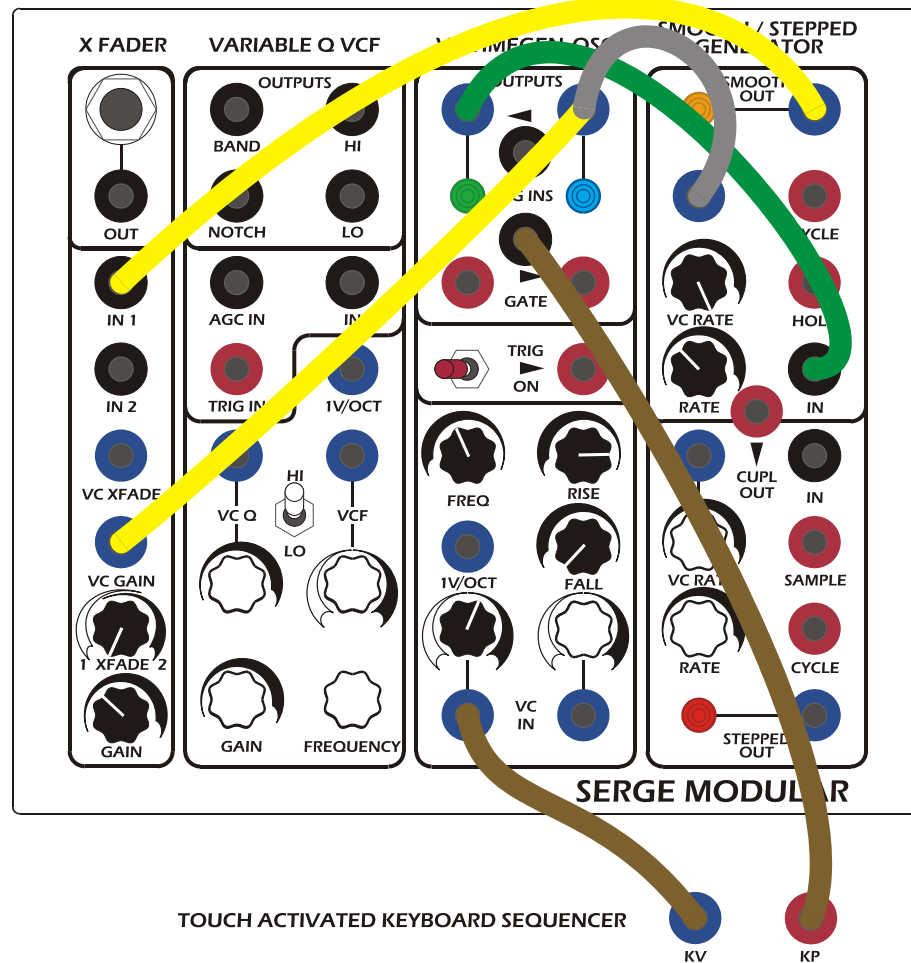
To create tones that are not evenly-timed, remove the right side of the yellow cable from the TGO and plug it into the SSG's "CUPL OUT" jack. Now the tone only sounds when the pitch-controlling voltage of the lower half exceeds the current voltage level of the upper half of the SSG.

Random Pitches from an LFO



This patch creates much the same effect as the previous one, but it is achieved a different way. Here, the top-half of the SSG is once again wired as an LFO, its output controlling the pitch of the TGO. The right-side of the TGO is also wired as an LFO that does two things—it provides an envelope for the XFAD acting as a VCA, and it also freezes the current voltage level of the SSG LFO each time a new note sounds.

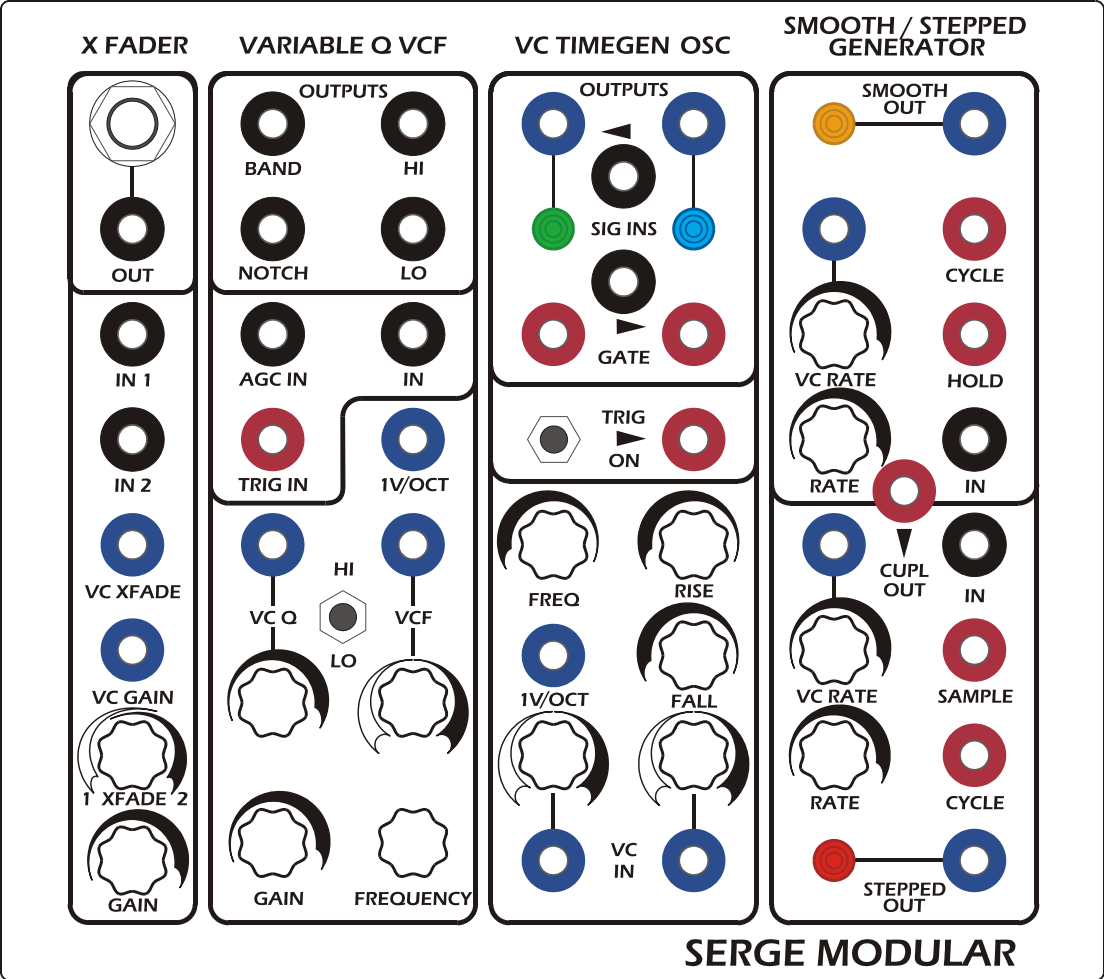
The Smooth Generator as a VC Lowpass Filter



Here, the upper half of the SSG, essentially an integrator, is being patched as a lowpass filter. The same envelope that controls the VCA functioning of the XFAD sweeps the cutoff frequency of the filter through the "VC RATE" jack and knob. Careful adjustment of the SSG's topmost "RATE" knob is needed to hear the effect.

Blank Patch Sheet

The following page contains a blank patch sheet that may be printed/photocopied for own your use.



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